RESEARCH, DEVELOPMENT & TECHNOLOGY TRANSFER
QUARTERLY PROGRESS REPORT

Wisconsin Department of Transportation
DT1241 4/2010

INSTRUCTIONS:
Research project investigators and/or project managers should complete a quarterly progress report (QPR) for each calendar quarter during which the projects are active.

WisDOT research program category: ☐ Policy research ☒ Wisconsin Highway Research Program ☐ Other ☐ Pooled fund TPF#		Report period year: 2011 ☐ Quarter 1 (Jan 1 – Mar 31) ☐ Quarter 2 (Apr 1 – Jun 30) ☐ Quarter 3 (Jul 1 – Sep 30) ☒ Quarter 4 (Oct 1 – Dec 31)
Project title: Foundation Movement for Transportation Structures		
Project investigator: Dante Fratta	Phone: 608-265-5644	E-mail: fratta@wisc.edu
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WisDOT project ID: 0092-09-05	Other project ID:	Project start date: 2/5/2009
Original end date: 2/5/2012	Current end date: 2/5/2012	Number of extensions: 0

Project schedule status:
☐ On schedule ☐ On revised schedule ☐ Ahead of schedule ☒ Behind schedule

Project budget status:

Total Project Budget	Expenditures Current Quarter	Total Expenditures	% Funds Expended	% Work Completed
$109,893.00	$2,361.00	$67,895.00	64%	58%

Project description:
The overall research objective of this study is to produce a document summarizing simplified design procedures for evaluation of foundation movements for transporation structures within the LRFD framework. Recommendations for the measurement and selection of input parameters for those design procedures will also be provided.

Progress this quarter (includes meetings, work plan status, contract status, significant progress, etc.):
• Continued monitoring of load measurementsat each of the exiting sites and analysis of data. Systematic data collection has been conducted by Mr. Justin Litch. Justin is an undergrate research assistant that will continue working on this project until June 2012.
• The collected data were reduced and one of the students assigned to this project is completing her thesis. Ms. Ivy Harnon is not being supported by this project and is expected to defend her thesis late May 2012.
• As part of her work, this master student evaluated the literature research and completed an inclinometer analysis for instrumenting future sites. The MOTES wireless tiltmeter sensors selected at the beginning of this project do not have the sensitivity needed to measure the small deformations expected in the instrumented bridges.

Anticipated work next quarter:
• Continued analysis and collection of data, including surveying of the four existing sites. These sites include the following bridges: Layton Avenue (bridge 40-0820), Lien Road & I90-39 (bridge B-13-541), St. Highway 164 (bridge 67-0325), and Co. Road P & I-94. In each of the bridges piers have been intrumented and in two of the bridges, aboutments have also been

instrumented other strain gauges. A senior undergraduate student is participating in the data collection and reduction.
• We have procured a new set of instruments that are ready to be installed if new sites become available (a new new bridge did not become available in Fall 2011).
• We will recruit another advanced undergrad student to make faster progress toward the completion of the study. We plan to run numerical simulations to justify the collected field measurements.

Circumstances affecting project or budget:

The project has been hit by several delays and logistical problems. For example, the project had problems getting access to sites for instrumentation and it also had problems with the selection of instruments (i.e., MOTES wireless tiltmeter sensors). The last site was available during the Summer 2011 and the instrumentation and data collection began during the Summer/Fall 2011 period.

A new principal investigator was assigned to this project when Prof. Schneider left the university in Summer 2011. Prof. Fratta started as new PI in Fall 2012. As part of this transition we discussed and agreed with WisDOT officials the need for a non-cost extension for this project. The request for non-cost extension was submitted in the 2012 First Quarter.

The original proposal called for the collection of data in fifteen different bridges. These bridges include five shallow bridges with shallow foundation systems, five bridges with deep foundation systems and, five bridges with abutments). So far the project was given access to four bridges (Layton Avenue - bridge 40-0820, Lien Road & I90-39- bridge B-13-541, St. Highway 164 - bridge 67-0325, and Co. Road P & I-94) with six different data access. These bridges were instrumented to measure vertical loads using strain-gage instrumented sister rebars and using surveying measurements to monitor the vertical deformation. The abutments were supposed to be instrumented with MOTES wireless tiltmeter sensors to measure the lateral deformations. However the resolution of these sensors cannot measure the small deformations expected at the sites.

To help reach the objectives of this project with the funds remaining in the budget, an alternative approach was discussed with Prof. Tuncer Edil (UW-Madison) and Mr. Andrew Hanz (WHPR) and is presented in this Quarterly Report. Given the fact that only four bridges with shallow foundation systems were properly instrumented, we proposed an alternative plan to monitor load and deformations of four other bridges: two with deep foundation systems and two with abutments. For those bridges, we are proposing to modify the instrumentation system to properly capture settlements and deformations using the remaining $39,636.67 in the project.

Tilt measurements: We have contacted Geokon (a leading company in the civil infrastructure instrumentation) and got verbal quotation for MEMS tiltmeter systems. Each Model 8003 LC-3 MEMS Datalogger costs approximately $1,000 and includes inclinometer, temperature sensor, and datalogger in a single unit. The accuracy of the system is 0.05 F.S. for tilt measurements and 1.0% F.S. and resolution of 0.1 C for the temperature. These specifications will allow to properly capturing the tilt of the abutments. We plan to install one tiltmeter sensor in each abutment bridge. Item cost: $2,000

Displacement measurements: We plan to continue using regular total station measurements. We will request permission from WisDOT official to establish accessible fix points in the structures.

Applied forces: to evaluate the applied forces to the foundation system we will be using Geokon system strain gauge rebars. Each system cost approximately $4,000 including four strain-gaged rebars and datalogger. We will need 3 systems as one of the systems is already in our laboratory waiting to be installed. Item cost: $12,000

Graduate student support: to support these efforts, we request to use the remaining funds to pay a graduate student at 33% for to two semesters. Item cost: $25000 (including stipends, tuition remission, and indirect costs).

Travel costs and supplies: $900

This alternative plan will require that WisDOT will give us access to the required four bridges. The completion of the measurements, the interpretation of the data, and drafting and completing the final report over the span of a year after the installation of the new sensor arrays will allow to provide an acceptable completion to the project.

Original GANTT Chart attached to this document and a new Gantt chart needs to be developed.

Attach / insert Gantt chart and other project documentation

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Staff receiving QPR:	Date received:
Staff approving QPR:	Date approved: